Human trophoblast stem cells: Real or not real?

Journal: Placenta

Publication Year: 2017

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PubMed link: 28087122

Funding Grants: Human pluripotent stem cell-based therapeutics for preeclampsia

Public Summary:
Placental stem cells have not yet been established for the human organ. This review describes where such cells may reside, and details evidence for these cells in different compartments (regions) of this organ at various times during its development.

Scientific Abstract:
Abnormal trophoblast differentiation is the root cause of many placenta-based pregnancy complications, including preeclampsia and fetal growth restriction. Human trophoblast differentiation is difficult to study due to the lack of a stem cell model. Such a multipotent "trophoblast stem" (TS) cell, with the ability to differentiate into all trophoblast subtypes, has been derived from mouse blastocysts, but attempts to derive similar human cells have failed. We consider here several possibilities for the TS cell niche in the human placenta. Aside from discussion of such a niche in the pre-implantation blastocyst, we discuss evidence for these TS cells residing in the post-implantation villous cytotrophoblast layer, or even in the non-trophoblast portions, of the human placenta. It is our hope that recognition of the niche would lead to successful derivation and in vitro establishment of such cells, which could then be disseminated widely to the placental biology community for advancing the field. Availability of self-renewing human TS cells, whose gene expression and environment could be manipulated, will provide a platform, not just for the study of pathophysiology of placental disease, but also for the discovery of diagnostic biomarkers and therapeutic targets for common pregnancy complications.